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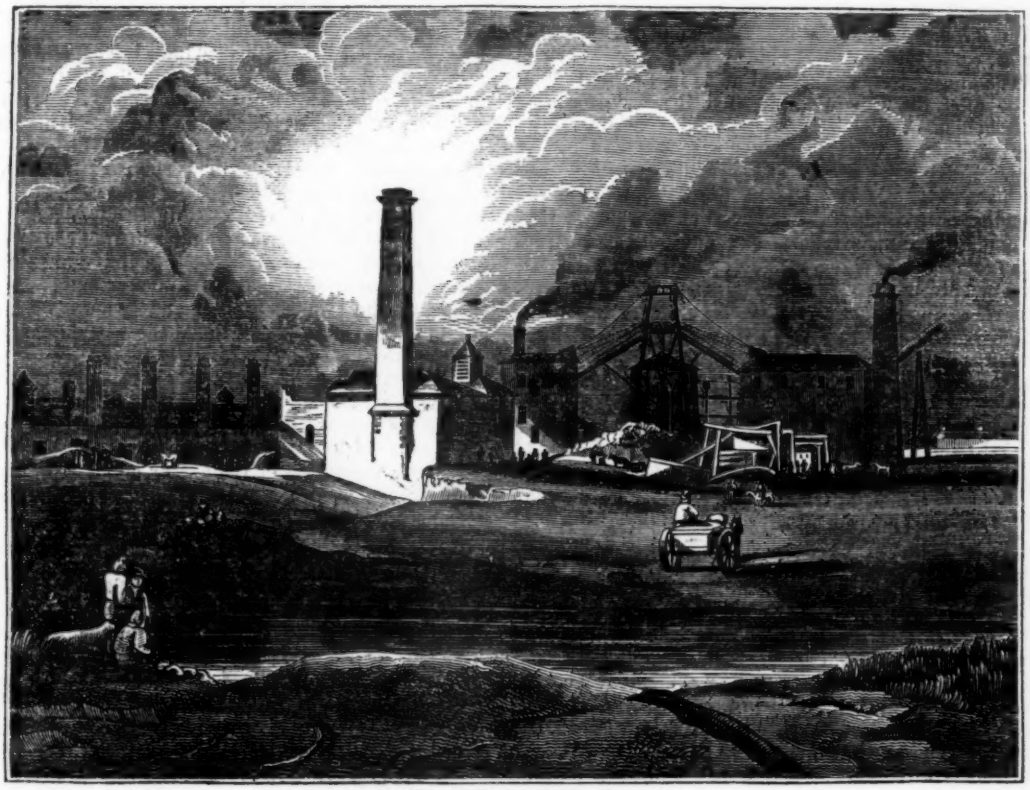
THE COLLIERIES.—No. I.



[South Hetton Colliery.]

NOTWITHSTANDING the variety and abundance of the productions which nature offers for our use in this country, and which we have with so much enterprize and skill made subservient to our comfort and wealth, they would have been of comparatively little utility to us at the present time, if we had been deprived of that one by which alone we obtain from others their most valuable properties. Without coal, in what manner could we now carry on our vast operations in every department of industry? In what way could we employ hundreds and thousands of our large population in fashioning those implements which so effectively aid us in extending our domain over the natural world? It is true that this mineral was not extensively used at a period when our manufactories were not altogether unimportant, although of very trifling extent when compared with the enlarged scale on which they are at present conducted; but, in those times, the woods which were spread over the country had not yielded to the encroachments of an increasing population; and as long as they existed, the fuel which they furnished was obtained at a cheaper rate than coal, which could only be extracted by the union of considerable capital and skill. In the mention which early writers make of our iron-works, fears are generally expressed respecting the decay into which it was imagined they must gradually fall by the disappearance of the native forests. These old smelting-works necessarily existed on a confined scale. It is not a hundred years since the iron ore in the Staffordshire mining district was carried, by a train of pack-horses from the pits, to be smelted. The employment of coal in the process of smelting was then unknown; and its successful application was a great relief to those whose fears had led them to regard the native iron-trade as doomed to extinction. While the forests flourished, it would have been altogether unprofitable to resort to an expensive mode of procuring fuel from the bowels of the earth, even if there had existed a sufficient amount of mechanical skill to have done so in any extensive manner. The moment when, by agricultural improvements and the successive clearing of the land, wood became scarce, the question was soon decided as to the advantage of making the necessary exertion to obtain coal.

It is not clear at what precise period this necessity sprung up. It is argued that the Romans continued unacquainted, if not with the existence of coal, at least with its useful properties, during the four centuries in which they held this country in their possession; and this opinion is maintained on the ground that no word is found for coal in the Latin language, although *carbo*, for charcoal, is not unfrequently met with. The use of coal was, however, well known to our Saxon ancestors, although its consumption was limited by the

causes to which we have alluded; and it is not improbable that at the same period several of the northern nations were equally familiar with its properties. Several terms in use among miners in England, Germany, and other countries of the north, have a striking resemblance to each other. The French word for coal is *houille*, which is very similar to the Saxon word *hulla*, although its more frequent designation in France is *charbon de terre*, or charcoal of the earth. The name by which coal is designated in Germany is *steinkohlen*, or stone-coal; by the Dutch it is called *steenkoolen;* by the Danes *steenkull;* by the Swedes *stenkol.* The Italians and Spaniards, having no familiar term for coal, employ a modification of its scientific name, *carbo fossilis.*

The progress which England made in the first 200 years after the Conquest prepared the way for the introduction of coal as an article of commerce. In the year 1239 Henry III. granted a charter for digging coal. Forty years afterwards Newcastle was celebrated for its coal-trade. In 1306 its use was prohibited in London, on account of the supposed effect which it had in rendering the air impure and unwholesome. But this prejudice was either soon dissipated, or the cheapness and excellence of the material, as an article of fuel, became so apparent, that the prohibition was not very effective, and probably was soon abolished. In 1325 coal was exported to France. In 1379 a duty of 6*d.* per ton was charged on ships coming to London from Newcastle with coals. At this period, also, a duty was levied on such ships by the Corporation of Newcastle, on their clearing out at that port. In 1384 Richard II., out of regard and reverence to the tutelary saint of Durham, exempted the coal-owners of the Wear from the above corporation duty. Pope Pius II. visited this island previous to his elevation to the papal chair, during the former part of the fifteenth century; and he remarked that the poor of Scotland received for alms pieces of stone which they burnt instead of wood. The earliest mention of coal-mines being worked in Scotland occurs in a charter granted in 1291 to the monks of Dunfermline, conferring upon them the privilege of digging for coal in the neighbourhood of their monastery. In the sixteenth century "sea-coal" was the general term applied to this mineral, which proves (as there were inland collieries worked at the time), that the state of the roads and means of communication were so imperfect, that the quantity which they furnished was trifling, and that the market depended almost entirely on the supply of sea-borne coals.

Two hundred and sixty years ago, Camden, who travelled in various parts of England, previous to the publication of his 'Britannia,' said in that work, when speaking of the now active district of North Staffordshire,—'The north part of Staffordshire hath coles digged out of the earth, and mines of iron. But whether more for their commoditie or hinderance I leave others to determine who doe or shall better understand it.' It will be curious to contrast the commercial importance of our mines at the present day with their state in the sixteenth century; and when we arrive at this part of the subject, the opinion of Camden may be referred to with some interest.

England is by far the richest country in the world as it respects her coal-mines. They have been the source of greater wealth to her than ever the gold mines of Peru were to Spain, because they are a means whereby man obtains a direct increase of power over materials which minister to his comfort. If he knows not how to use these materials, he remains in a state of comparative barbarism; or if he possesses that imperfect skill which only enables him to effect this in an inefficient and expensive manner, he cannot, under certain circumstances, rise above a state of comparative poverty.

The different coal districts of England and Wales are arranged in the following manner by Messrs. Conybeare and Phillips:—

1. *Coal district north of Trent*, or grand Penine chain.—1. Northumberland and Durham; 2. North of Yorkshire; 3. South York, Nottingham, and Derby; 4. South of Derby; 5. North Stafford; 6. South Lancashire; 7. North Lancashire; 8. Cumberland and Whitehaven; 9. Foot of Crossfell.

2. *Central Coal district.*—1. Ashby de la Zouch, 2. Warwickshire; 3. South Stafford or Dudley, 4. Indications near the Lickey Hill, &c.

3. *Western Coal district*, divided into, 1. *North Western* or *North Welch.*—1. Isle of Anglesea; 2. Flintshire.

4. *Middle Western or Shropshire.*—1. Plain of Shrewsbury; 2. Colebrokedale; 3. The Clee Hills and South Shropshire; 4. Near the Abberley Hill.

5. *South Western.*—1. South Wales; 2. Forest of Dean; 3. South Gloucester and Somerset.

Considerable beds of coal exist in Scotland; and it has been found in seventeen counties in Ireland. The largest coal field on the continent is in Belgium; there are smaller ones in several parts of Germany. Coal abounds in the United States; and is more or less found in a line which sweeps round the globe from the north-east to the south-west. It is impossible to regard this extensive provision of so valuable a substance, which in some places has been in a course of consumption for some centuries, and in others yet offers almost inexhaustible stores, without a strong desire to know something of the history of its formation. For this knowledge we must refer to the 'Penny Magazine,' Nos. 100, 102, 105, 108, 109, 110, and 111, in which, under the head 'Mineral Kingdom,' the subject is treated under its appropriate divisions. It may, however, be desirable to state in this place that the formation of coal is attributed to trees and vegetables being carried down the rivers of the primeval world, and deposited in the bed of the sea, in an age of which we have obtained some definite conceptions by the most interesting science of geology. The probable process of the formation is accounted for in the Numbers of this Magazine to which we have already referred. The irregularity of the coal seams is occasioned by subsequent convulsions to which the earth has been subjected. These have produced what the miners call faults or dykes, which often interrupt the labours of the pit, by affording a passage to the water. A fault or dike is in fact a fissure or rent, which appears to have been effected by some tremendous power. A district in which mines are found is called a coal-field. Coal-measures is the term which miners give to the successive strata which are found alternating with beds of coal, such as slate-clay, freestone, &c.

The traveller who visits for the first time an extensive coal district will be struck by the vast canopies of smoke continually rolling their sluggish course in the direction of the wind. This smoke arises from the engine fires and from the small coal burnt at the mouth of the pit. On the clearest day these fires impart a cloudy aspect to the landscape. If a visit to the great northern coal district be the object of the traveller's journey, he will find on the road from Newcastle to Durham, which is on elevated and rising ground, a series of magnificent views successively burst upon him, almost unequalled in any part of England. At intervals, as he ascends, a wider horizon spreads out before him, the hills are bold and picturesque, and occasionally exhibit in their sweeping outlines combinations of unusual grandeur. When he at length reaches the coal-fields, he will find the face of the country black and blasted; and this appearance, united with the perpetual clatter of the waggon trains,

may fill him with somewhat gloomy feelings. When the first impressions of the traveller have subsided, and he looks more narrowly at surrounding objects, he cannot fail to be strongly impressed with the vastness and extent of the commercial enterprize of the district. On every side rise extensive buildings, and in the centre of each, one more lofty than the rest contains that mighty power which has created by its effects more than one-half of this sphere of human activity. These buildings are the works connected with the collieries. In the neighbourhood of the northern coal-fields the landscape is studded with a number of mansions, situated in the midst of extensive grounds, in which the coal-owners and capitalists whose property is connected with the collieries reside. In the present paper we shall confine our description to the northern collieries: those of the central coal district will be more properly connected with some future account of our iron-works.

Many years ago, before the science of geology had assumed so positive a character, much capital was, almost literally speaking, sunk in the attempt to discover coal. It has since been found that many of the indications which were then looked upon as a proof of its existence beneath the surface were often geologically erroneous, and necessarily led to disappointment. At present, when speculations of this kind are conducted on safer foundations, the greater part of the collieries are leased for a term of years. As property of this description cannot be insured from the risks either of fire or water, to which they are alike liable; and as large properties are required to ensure all the operations connected with the works being at once perfect and economical, the combination of a number of men of capital is doubtless an advantageous arrangement.

The animated parts of the scene in a northern coal district are not less peculiar than the other characteristic objects which strike the eye. Occasionally bands of "pitmen," as black as sweeps, each man carrying a safety-lamp suspended at his belt, are seen traversing the dingy lanes on their return from an eight-hours' "shift" of labour. The physiognomy of the miners is not of course of a very intellectual cast; but from the nature of their occupation, and from living, as they do, in a great measure apart from other classes of the community, its peculiarities are strongly marked. These have been transmitted from one generation to another, owing to the unions which they form being almost exclusively confined to families whose pursuit is similar to their own, and consist of high cheek bones, great width of the middle part of the face, and an angular form of its lowest portion. In these respects they are quite a distinct race from the neighbouring peasantry. The colliers who work in mines where the seam of coal is of sufficient thickness to permit the free use of muscular action, are erect and of good figure; while in others where the seam is of smaller dimensions, the miners have the spine permanently curved, and the legs frequently bowed. Their complexion, when it can be seen in its own hue, is generally sallow and unhealthy. Owing to the unusual light by which they pursue their occupations, the eyelids often become swollen, and the eyes assume a diminutive appearance. The strong light of day occasions them to experience a somewhat painful sensation. The dress of the colliers is necessarily characteristic. Their working clothes consist of a tunic or short frock, and trowsers of coarse flannel. Their holiday clothes are generally of velveteen, decorated with a profusion of shining metal buttons.

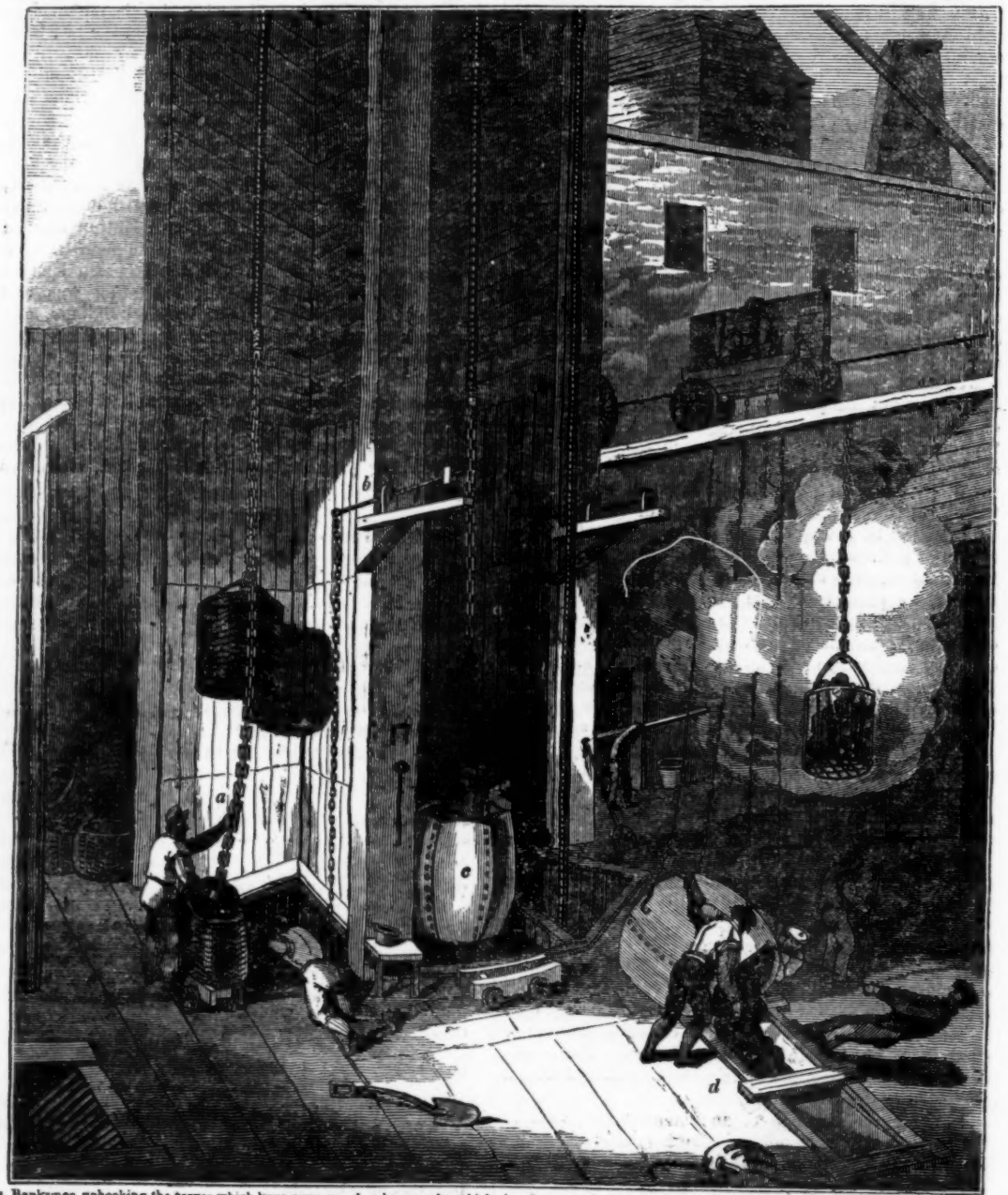
In the neighbourhood of an extensive coal-work in the north, there is usually a village exclusively inhabited by the pitmen and other persons connected with the colliery. These places have a singularly unpicturesque appearance. The houses consist each of one room, with a wash-house behind, and a chamber over the whole, access being obtained to the latter by means of a ladder. About two hundred such abodes, ranged at irregular intervals alongside the road, constitute one of these hamlets. Heaps of ashes and other refuse are suffered to accumulate before the front and back-doors; and upon these, during fine weather, a number of robust and half-clothed children, of an age too young to be employed at the works, are too often suffered to idle away the day. In front of every fifth or sixth house stands a bake-house for common use, which contains a large brick-built oven. Early in the morning the wife and daughters of a pitman may be seen assembled there with sundry old gossips, to bake a week's bread for the family; and to a person who has no previous idea of the sharpness and extent of a pitman's appetite, the size of the loaves may perhaps be a matter of some astonishment. Before the front window of each tenement stands a pile of small coal, which is replenished every week by a gratuitous cart-load from the pit. The fires are consequently large; and to the rapid ventilation thereby produced the general good health of the household is to be attributed, in spite of their too frequent disregard of habits of cleanliness.

If a new colliery is opened in a part of the country where such a work had not previously existed, the colliery village springs up in necessary connexion with it, and a previously dreary and uninhabited district becomes full of life and activity. South Hetton may be mentioned as an example of this rapid growth of a community. Five years ago it was a barren spot of ground, from which the nearest habitation was two miles distant. Now it is covered with buildings, and contains a population of 2000 persons, who are exclusively connected with the coal-works. As an enumeration of their various occupations, and the number of persons connected with each, affords no bad idea of the distribution of labour which this branch of industry calls forth, we have procured an accurate census of the male working population of South Hetton, which we subjoin:—

Officers.	
Manager	1
Viewer	1
First Engineer [Commonly called Agents.]	1
Second Engineer	1
Surgeon	1
Clerks	4
Workmen above Pit.	
Joiners and Sawyers. (These men keep the works in repair.)	13
Engine-Wrights. (Repair and make the machinery.)	7
Engine-Men. (Keep the machinery in action.)	8
Firemen. (Attend the boilers.)	9
Smiths. (Prepare the iron-work in the rough.)	18
Masons	8
Labourers to do.	6
Cartmen	11
Horsemen	9
Saddler	1
Waggonway-Wrights. (Lay down and mend the rails on the rail-roads, &c.)	6
Waggon-Riders. (Conductors of the waggons, of which there is one to each train.)	11
Staithmen. (Attend at the staith to empty the waggons of their coals into the ships.)	4
Bankmen, who deliver the corves	8
Waggon-Fillers and Screeners	12
Wailers. (Boys who pick out the stones and otherwise clean the coals.)	9
Corvers or Basket-makers	4
Heap-keeper. (Looks after the quality of the clean coals.)	1
Store-keeper. (This man presides over a vast magazine of stores, which he delivers to the men as they are wanted.)	1
Attendants on Railway, including Engineers and Furnace-men	8
Trimmers. (Men who fill up the holds of vessels with the coal discharged into them from the staiths.)	8
Boys for sundry purposes	39
Carry over	210

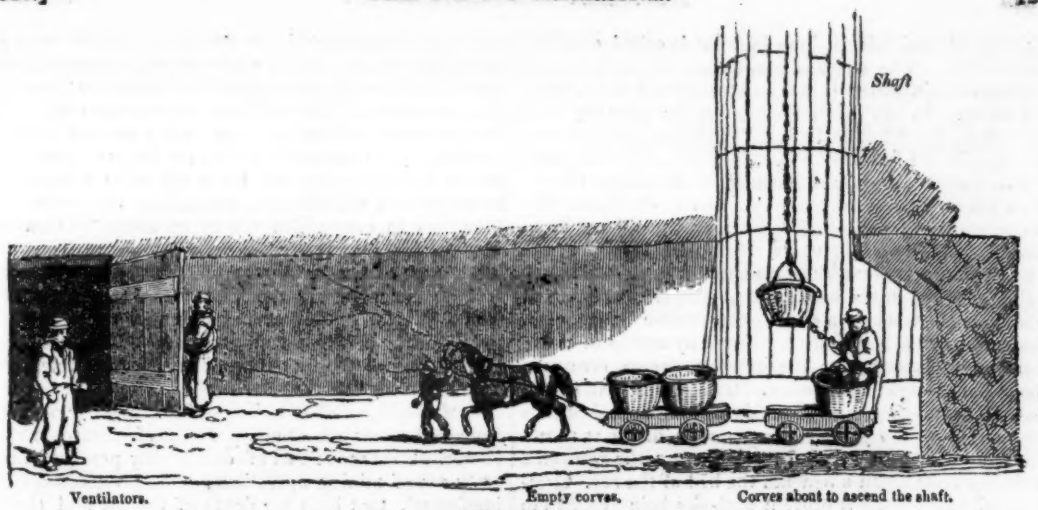
Brought forward	210
WORKMEN IN THE PIT.	
Hewers. (Miners who "hew" out and blast the coal.)	140
Putters, who "put" the corves on the trains; Dragmen and Foals, who draw them to the bottom of the shaft; Helpers-up and Trappers, who manage the ventilating doors	140
Deputies or Foremen; Ventilators, Shifters, or Pit-Masons, &c.	36
TOTAL	526

In passing through the northern colliery-villages, it is curious to remark how strikingly the character of each family is indicated by the appearance of their respective dwellings. The residence of a steady and industrious workman is distinguished by a neatly white-washed door-stead; the windows are furnished with curtains, and contain a few choice plants in bright red pots; and not unfrequently a written or painted notice announces that the good housewife prepares herb-waters, or exercises her industry in some other way for the advantage of her family. In the interior of the cottage may be seen a good and decent four-post bedstead, an eight-day clock, a venerable oak-table, and perhaps a few books. In melancholy contrast with such gratifying indications, a little further on stands a cottage destitute of the commonest household conveniences, and marked by a dirty, comfortless, and neglected appearance. In the middle of the floor, in rainy weather, it is not uncommon to see perhaps half-a-dozen children playing with what they call a "cuddy," or, in other words, an ass, introduced in this unsuitable place, with a careless disregard to comfort and propriety The only inhabitants of these villages, besides the work-people and colliery agents, are, the butcher, the general



a, Banksmen unhooking the corves which have come up; *b*, a hammer by which signals are made from the bottom of the shaft; *c*, two miners descending in an iron-tub; *d*, Banksmen and boy shooting a tub of coals through the screening-holes.

[Mouth of Coal Pit.]



[Pit Bottom.]

chandler, and the publican. Of butchers and chandlers there is seldom more than one each, but of publicans there are generally six or seven. To the practice of indulging at the public-houses is to be attributed the degradation of some of the pitmen, and the misery of their families.

As the influence of the great coal owners and lessees can be exercised in so direct a manner on the large population whose industry is sustained by means of their capital, it is to be regretted that it is not more generally employed in calling forth an improved state of moral feeling among them, and exciting some relish for pleasures less debasing than those in which they are now too much habituated to indulge. The collier's cottage might, under due regulations, be provided with a garden; and a love for the simple pleasures which it would afford might perhaps be more easily fostered than any other.

The terms by which the colliers are connected with their employers, are usually an engagement for twelve months at a fixed sum, generally 14*s.* or 15*s.* a-week. This they receive whether employed or not; and it does not unfrequently happen that they are in the receipt of it for many weeks, when it is not possible to carry on the works, owing to the drowning of the pit, or the occurrence of some other unexpected impediment. Besides this, they are paid by the piece. The employers provide a house, and supply the family with coal gratuitously, or in some cases the small sum of 3*d.* per week is paid for these advantages. The bond, containing the terms of agreement, stipulates all the conditions into which the parties mutually enter. A bounty or increase of wages is commonly given to the workmen to induce them to break the coal as little as possible. When work is abundant, and there is not too great a number of hands, the best workmen have been known to obtain, at a particular description of work, from 10*s.* to 12*s.* a-day. Their earnings are of course much lower on an average, and may be taken at from 15*s.* to 20*s.* per week, from which, it should be recollected, there is no outgoing for rent or fuel. At times, when work has been less abundant, and the supply of hands unusually great, wages have sometimes been as low as 8*s.* or 10*s.* a-week. Some decrease has taken place in the average amount of wages during the last twenty years; but the reduction is not so great as that which has taken place in the cost of all the first necessaries of life. The men generally work from eight to ten hours a day, and they are in the mine at a very early hour in the morning. In extensive works there are different sets or shifts of men, so that the operations are carried on unremittingly. Boys are found useful at a very early age,—so early as seven,—and are employed in opening trap-doors, driving horses, propelling trucks, &c.

It is gratifying to remark that, in spite of the obstacles which may operate against the formation of provident habits among the colliers, the deposits in the Savings' Banks of the two northern counties, in which the coal-trade is the most active and predominant branch of industry, are such as not only prove the existence of considerable prosperity, but indicate a wider prevalence of economy and foresight than we could have anticipated.

Having thus endeavoured to present a picture of the general condition and economy of a colliery village, we shall now attempt to explain the operations connected with the working of a colliery. The coal-works of Colonel Breddyl, at South Hetton, near Durham, are perhaps better calculated than any other to display all the operations of a colliery in the highest degree of perfection, owing to their very recent establishment. The machinery is all new, and of the most improved and scientific construction, and the whole of the arrangements are on an extensive scale. The various operations may be divided into five series:—

1. *Winning the Coal.*—The first thing to be done in establishing a colliery is to survey the ground which it is proposed to open, which is done by an individual called a *viewer*, who ought to possess not only scientific attainments, but extensive practical knowledge, as his task is one of great importance and responsibility. Not less than 50,000*l.* have been sometimes expended to no purpose in endeavouring to procure coal; and the useless consumption of so much capital has been frequently occasioned by the erroneous judgment of the viewer. Cases of this description are, however, now of rare occurrence. The expense of sinking a pit varies from 10,000*l.* to 150,000*l.*

The average expense incurred in the operation, including the steam-engine and its apparatus, is about 30,000*l.* The site being determined upon, the sinking of the shaft is commenced, and a steam-engine is erected on the spot to work a set of pumps for drawing off the water which the "sinkers" encounter in their descent, and also to raise to the surface the excavated earth and other materials. While the sinking is proceeding, every part of the process is carefully noted in a journal kept for the purpose. The volume of water which is met with is accurately measured in vessels containing fifty or sixty gallons, and the time which each takes in filling observed. Means are then used to stop the apertures by which the pit is

inundated, and this is done by what is called cribbing or tubbing. The shaft is cased with strong boarding or brick-work, which is progressively done as the work advances. In the South Hetton Pit the shaft is 1080 feet deep, the "low main-coal," which is the best and thickest in the field, lying at this depth. The labour of sinking such a shaft is immense, and the danger of suffocation imminent, from the irruption of water, the disengagement of pernicious gases, or the falling in of materials. The inflammable air or gases, found in the strata, would, if allowed to accumulate, affect the safety of all engaged in the works. The proper ventilation of the mine is therefore a point of immense importance, and rarefication is usually produced by means of a fire constantly kept up for the purpose, which creates a powerful draught from below. The deepest pit in the northern coal-field, and probably in England, descends to a depth of 360 yards. The average depth is somewhat under 150 yards. In some cases the workmen carry on their labours beneath the bed of the sea. Commercial considerations prevent coal-pits being carried to a lower depth, as the impediments which are then met with can only be overcome by great additional outlays of capital. The shallowest of the northern pits is forty-six yards deep, but it only furnishes an inferior description of coal. The strata successively passed through by the sinkers affords matter of curious speculation to the geologist. We have been favoured by Mr. Buddle, one of the most experienced coal-viewers in England, with a very accurate statement of the series of strata met with in sinking the Eppleton Jane Pit, from which the following abstract has been prepared :—

After passing through four different strata, consisting of the alluvial cover, sand and gravel, limestone, and yellow sand, water was reached which produced 360 gallons an hour. In the next eight yards, seven other strata occurred, and the influx of water now increased to about 4200 gallons an hour. At sixteen yards ten inches below the surface, the first coal-measure was met with. The whole of the water was stopped by 'cribbing.' The progress of the work, from the commencement to its termination, was as follows:—12 strata to the first coal-measure; 10 strata to the second; 6 strata to the third; 5 strata to the fourth; 6 strata to the fifth; 7 strata to the sixth; 7 strata to the seventh; 4 strata to the eighth; 5 strata to the ninth, or 'three-quarter coal-seam,' with about 20 inches of coarse top coal and coarse coal at bottom; 6 strata to the tenth coal-measure; 2 strata to the eleventh; 3 strata to the twelfth; 10 strata to the thirteenth, 'coal high main,' at a depth of 296 yards: a stratum of 'blue metal, very mild,' was found below this, when the 'low main of coal' was reached, containing 5 feet 6 inches of good coal, 3 inches black swad, and 1 foot 10 inches of bottom coal. Beneath this, 3 strata were passed to a measure of splinty coal; 5 strata to another measure 10 inches deep; 6 strata to another measure; and 11 strata to the 'Hetton coal-seam;' the depth from the mouth of the pit to the thill of this seam being 348 yards 11 feet 2½ inches. Excavations were made 6 yards 5 feet 4 inches deeper, making the total depth of the pit 356 yards 2 feet 3½ inches, in the course of which 132 strata, including the various coal-measures, were cut through.

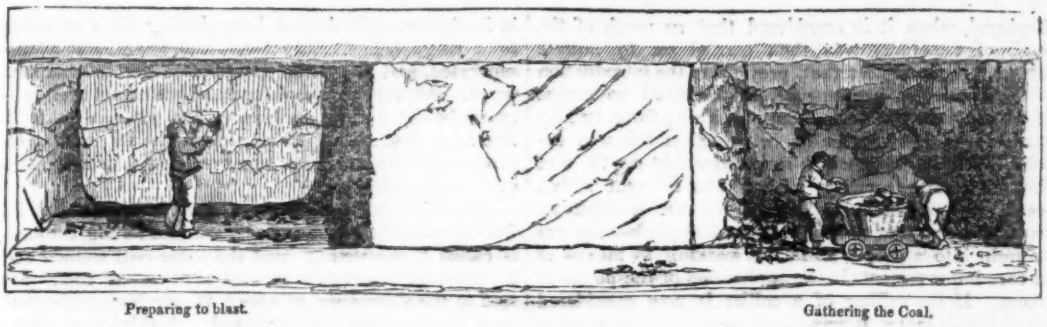
While the shaft is sinking, the necessary buildings are in course of erection, and the machinery and apparatus for "winning the coal" are got into a state of readiness. A platform is laid down round the mouth of the pit, about twelve feet above the level of the ground, called a "bank," or "bank-top," upon which the coal is landed. A more powerful and complete winding apparatus is affixed to two or more steam-engines for raising the coal; larger pumps are added to the engine for drawing off the water; supplementary boilers are erected for the generation of more copious supplies of steam; ventilating fires and draught-doors are prepared for exhausting the foul air of the pit, and supplying it with a current of fresh air; rail-roads for the conveyance of the coal to the nearest harbour are laid down; houses are built for the accommodation of the work-people; and when all these subordinate arrangements are finished, and all the ingenious combinations to accomplish the great object in view are brought into a state of efficient order under the superintendence of the principal agent and engineers, a day is fixed for bringing the first "coal to bank." The whole "country side" assemble on the occasion; and the opening of the pit, the winning of the coal, and the starting of the first train of waggons, is celebrated with the most lively joy.

2. *Pumping and Winding.*—The pumping of water from coal-mines was at one period performed by men or horses. This mode was of course only practised in an early era of mining operations, and was necessarily so ineffectual, that both the depth of the pit, and the extent to which it could be worked, were in consequence very limited. The hydraulic engine, or water-wheel, with cranks and vibrating beams, appears to have been introduced in colliery works in the year 1680, and into Scotland about the year 1712. About 100 years ago this mode was superseded by Newcomen's steam-engine; but even that was not of much value in pits which were as deep as 120 yards. The pumping is now effected in pits of much greater depth by the powerful and splendid engines of the present day. At South Hetton, at the back of the shaft, a noble engine-house is erected of massive stone, which contains an engine of 300-horse power. This engine is the most powerful one in the district, and its magnificent action may be seen to great advantage from three galleries which surround the interior of the engine-house. The sole business of this engine is to pump up the constantly accumulating waters of the pit, which it discharges into an adjacent reservoir from which the boilers are supplied. The constant and steady exertion of its power is as necessary as the beating of the heart to the continuation of animal life. Any impediment to its operations would be attended with disastrous consequences, and on it goes, day and night, from one year's end to another, until accident, or the wear and tear of some of its parts, bring both itself and the industry of the pit to a stand.

Adjoining the above engine, in buildings erected for the purpose, are three winding engines of ninety-horse power each, for drawing up or bringing to bank the tubs, buckets, or corves containing coal, and for enabling the workmen to descend the shaft. This is accomplished by two sets of ropes, each weighing thirty-eight cwts., which are coiled or uncoiled from two large drum wheels, as the ascending or descending motion is required. The day is chosen as the most convenient time for bringing up coal, and the night for sending down provender for the horses and the various stores.

The engine which keeps the pumps in action is furnished with four enormous boilers, and the smaller ones with two each, of proportionate dimensions. Two supernumerary boilers are kept, in order to be ready, should those in use sustain any injury. The fact that the power of 570 horses is constantly exerted in effecting the two simple operations of pumping, and drawing up the coal, affords a striking illustration of the magnitude of the operations connected with first-rate colliery works.

3. *Mining.*—We must beg the reader to imagine himself in a gloomy excavation or subterranean passage about eight feet high and fourteen feet wide. This is one of the "ways" of a coal-pit, the bottom of which



Preparing to blast. Gathering the Coal.

is called by the miners the thill, and the top the roof. Here and there along the walls of this passage a safety-lamp is suspended; and when the intense darkness of the place is occasionally illuminated by the slight ignition of the fire-damp, the whole scene presents an extraordinary appearance. The generation of inflammable air is frequently so great from the solid coal that the miners dare not proceed onward above a few feet from the current of fresh air. The light afforded by the safety-lamps seems to possess an unusual illuminating power; but though the visitor can see perfectly well, he still feels encompassed by pitchy and midnight darkness. In these galleries the miners or hewers, as they are called, carry on their work, in pairs, each taking about twelve feet of the side wall to excavate, and leaving between each such space an interval of the same width on which the roof may securely rest. The first process is to form what is denominated a "bord," which is done by digging out the coal from the bottom with a pick, as is represented in the cut, to a depth of three or four feet. The "bord" being completed has next to be formed into a "judd:" this is effected by picking away the sides, as had previously been done with the thill; and when finished, it forms a projecting mass of coal measuring on its surface about eleven feet by six. Into this judd a deep sloping hole is then bored, which is filled with gunpowder and fired by a train, when the judd is shivered into large fragments and scattered over the floor. In this way much labour is saved, and a larger and more profitable sized coal is secured for the market.

The coal seams of Yorkshire average from one and a half to nine feet in thickness, while in the more northern coal-fields they run from two and a half to seven feet. Near Dudley, in Staffordshire, is a seam of coal known by the name of the ten-yard coal, from its extraordinary thickness. This remarkable bed is about seven miles long and four broad. Seams of coal have been worked as thin as eighteen inches, and instances have occurred

Pitmen forming a "bord." Dragsman and Foal. Forming a "judd."

of seams being wrought only twelve inches in thickness. Young men and boys are employed under such circumstances. The differences of thickness sometimes admit the erect posture, and sometimes oblige the men to sit, recline, or bend the body to an extreme degree. They often work almost naked, either for the convenience of motion, or from the effect of the atmosphere, which is always at a high temperature in coal-pits.

On the coal being detached in the manner above described, a corve, tub, or basket, is then brought to the spot on a four-wheeled train, by a man and boy, technically called a "dragsman and foal," and when filled with the scattered fragments, it is dragged to the bottom of the shaft, hooked to the end of the rope, and drawn to the top in about three minutes. When the corves are made of iron they are called tubs, and the labours of the dragsman and his assistant are then performed by horses. When the corve arrives at the mouth of the pit it is received by the banksman, by whom it is landed. It is his duty to see that it is properly filled, and that the coal-owner gets his proper measure from the pitmen. He also keeps an account of the quantity drawn up, for which service he is paid three farthings per London chaldron.

Plot, in his 'History of Staffordshire,' written about 150 years ago, says that about Dudley, Wednesbury, and Sedgley, or within a circuit of ten miles, "there are usually twelve or fifteen collieries in work, and as many out of work. Some of these afford 2000 tons of coal yearly; others 3000, 4000, or 5000 tons." This was in the very centre of the richest part of the Staffordshire coal-field, which now ranks the fourth in the kingdom for the extent of its supplies; and at that time coal was not consumed for domestic purposes only, but likewise in many manufactures. The amount raised annually was probably about 60,000 tons. About one-half the collieries were out of work, owing most likely to the impediments which occurred in them being of a nature which the mechanical powers of the machinery then employed could not overcome. In the same district alluded to by Plot, there is now used, not reckoning that employed in the general manufactures which are so extensively carried on in that quarter, and excluding the quantity consumed for domestic purposes, 1,725,000 tons of coal annually, in rendering iron fit for the processes which it has to pass through in its conversion into articles of utility. For this one purpose alone the consumption is now thirty times greater than it was in the year 1680, when applied to a multiplicity of uses. *In eighteen hours* the South Hetton pit sometimes sends to bank as great a quantity of coal as would fill thirty of the Thames barges, or above 600 tons, while in Plot's day, the whole of the collieries situated in a most productive district did not in the same time supply one-third of this quantity.

We need not wonder at the striking contrast here

displayed, when it is considered that so much of the work of a colliery was then carried on by human labour. We have seen that, previous to the introduction of Newcomen's steam-engine, there existed no means of drawing out the water from pits above forty or fifty yards deep; but that on its introduction this was accomplished in those which were twice that depth, and thus a greater quantity of coal was brought within reach, and rendered serviceable whenever it might be required; and that now pits above 300 yards deep are brought into a proper state for working by means of further improvements in the application of the power of steam. If the calling of a collier is now considered repulsive by many, it was much more so a century or two ago, when the most slavish labour of the mines was performed by men, and even women, instead of by steam-engines. The lowest part of some of the earliest mines was reached by inclined planes, along which women carried the coal from the depths of the pit to the surface in baskets which they bore on their backs. The women employed in this degrading occupation were termed bearers, and each carried a weight of from one to two cwts.; sometimes they carried three cwts. Even after the period when the coals were drawn up a perpendicular shaft by machinery, women were employed in carrying the coal from distant parts of the pit to the bottom of the shaft; and in some collieries 60,000 tons have annually been carried in this way. It is only within the last half-century that women have been relieved from such unsuitable employment.

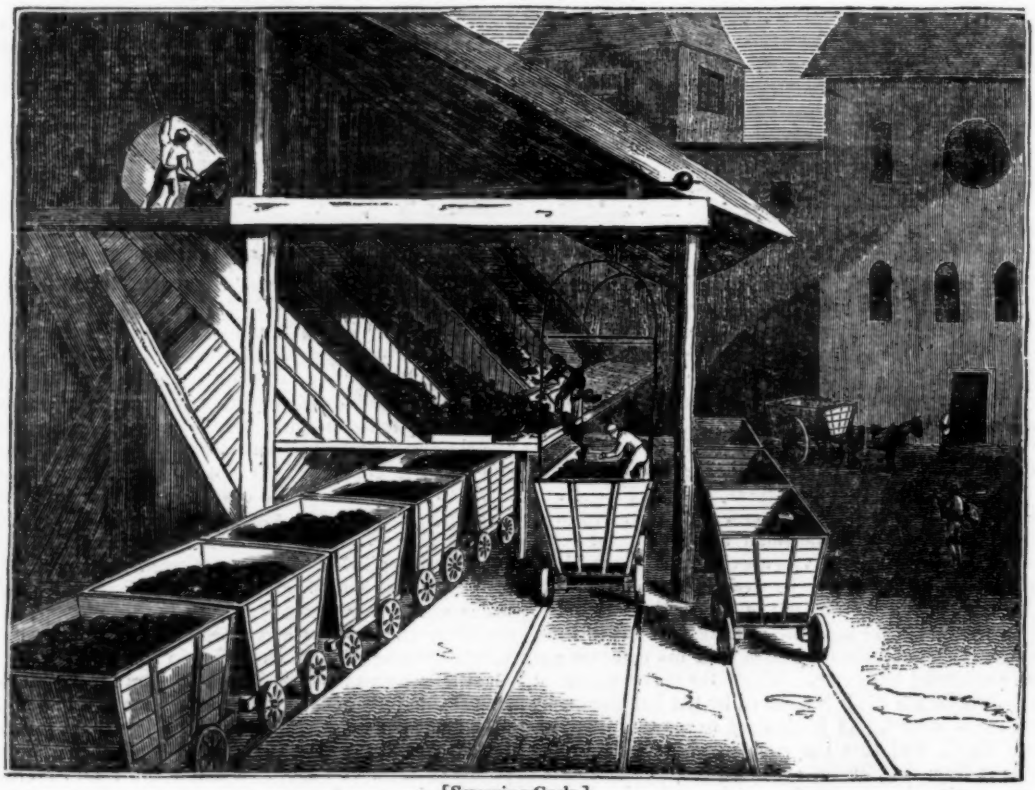
4. *Screening.*—When the corve is received by the banksman, it is conveyed, either by a train or a new suspensory apparatus, to one of a series of trap-doors in the bank-floor, through which the coal is teemed, and in its descent rolls down a long sloping sieve or screen to a stage below. The large and small coal is thus separated, and the latter is collected for inferior purposes. All the large coal for the London market is so carefully sifted that, on leaving the pit, it is perfectly free from dust and small particles. In its subsequent progress to the consumer the breakage which occurs is of course inevitable.

All coal which passes over a sieve whose meshes are five-eighths of an inch asunder without falling through, is called "Wallsend;" and the same coal teemed over a three-eighth screen is vended as "second coal," and sold to the shipowner at about 4*s.* per Newcastle chaldron less than the best Wallsend. A third sort, called "nuts," is obtained from that which had fallen through the screen in procuring the Wallsend and seconds; and a fourth termed the "dead small," from that which falls through in the preparation of the nuts.

The screened coal is collected on a wooden stage, and shovelled into the waggons which are brought underneath, and which are each made to contain exactly fifty-three hundred weight. While this is doing, several men and boys pick out any stones, slate, or other refuse with which the coal may happen to be intermixed.

The best coal for domestic consumption is the worst for a blacksmith or a founder. It sometimes happens that the produce of a pit containing inferior coal is selling in the market for a higher price than the best coal, in consequence of an increase in the demand of that required for manufacturing purposes.

In a subsequent Number we shall follow the further progress of the coal on its passage to the consumer, and enter into some particulars showing the commercial importance of the coal-trade



[Screening Coals.]

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